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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/911,731	07/25/2001	Tatsuya Kawahara	77661/54	5591

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EXAMINER

CREPEAU, JONATHAN

ART UNIT	PAPER NUMBER
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1746

DATE MAILED: 07/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

J.C.

Office Action Summary

Application No.

09/911,731

Applicant(s)

KAWAHARA ET AL.

Examiner

Jonathan S. Crepeau

Art Unit

1746

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
 Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 June 2004.
 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3 and 6-27 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 1-3, 6-14, 16-18, 20-22 and 24-26 is/are rejected.
 7) ☒ Claim(s) 15, 19, 23 and 27 is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date _____.
 4) ☐ Interview Summary (PTO-413)
 Paper No(s)/Mail Date _____.
 5) ☐ Notice of Informal Patent Application (PTO-152)
 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 10, 2004 has been entered.

This Office action addresses claims 1-3, 6-11, and newly added claims 12-27. Claims 1-3 and 6-11 are rejected under 35 USC §112, first and second paragraphs but contain allowable subject matter. Claims 12-14, 16-18, 20-22, and 24-26 are newly rejected under 35 USC §103, and claims 15, 19, 23, and 27 also contain allowable subject matter. This action is non-final.

Claim Suggestions

2. In claim 10, part (4), and also in claim 27, "said upstream portion" appears to be incorrect and should be changed to "said downstream portion." The recitation conflicts with the corresponding recitation of claim 9 and also is not supported by the drawings of the application. However, the error appears to be repeated in the specification at page 12, line 21. Appropriate correction is suggested.

Claim Objections

3. Claim 16 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 16 substantially repeats subject matter recited in parent claim 12. Thus, claim 16 does not properly further limit claim 12.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-3 and 6-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 contains two recitations enumerated number (3); the first limitation reciting that the pore amount is "smaller at said upstream portion than at any other portion of the catalyst later," and the second limitation reciting that the pore amount is "larger at said upstream portion than at any other portion of the catalyst later." These two recitations are mutually exclusive. It is suggested that "said upstream portion" in the second recitation be changed to "said downstream portion" as noted in the paragraph below.

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6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claims 1-3, 6-11, 18, and 24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. As noted above, claim 1 contains conflicting recitations regard the pore size of the catalyst layer. The correct recitation, based on the specification, appears to be the first one. Thus, it is suggested that "said upstream portion" in the second recitation be changed to "said downstream portion." Claim 18 also contains the incorrect recitation and should be amended accordingly.

Claims 10 and 24 recite that the pore size of the diffusion layer is "larger at said upstream portion than at any other portion of the diffusion layer." This recitation is not supported by the specification or originally filed claims and should also be amended to recite the downstream portion rather than the upstream portion.

Claim Rejections - 35 USC § 103

8. Claims 12-14, 16-18, 20-22, and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilkinson et al (U.S. Pre-Grant Publication No. 2003/0082432) in view of Cavalca et al (U.S. Pre-Grant Publication No. 2001/0033960).

Regarding claim 12, Wilkinson teaches a polymer electrolyte fuel cell in paragraphs 4 and 36. The fuel cell includes an electrode (40) comprising a catalyst layer (45) and a substrate (diffusion layer) (42) (see Figure 1). Regarding claims 20, 21, 24, and 25, the porosity (pore amount) and pore size of the substrate increase as the substrate is traversed in-plane in a downstream flow direction (see claims 9 and 10 of the reference). Regarding claims 12, 22, and 26, the substrate may comprise a water repellent layer which may increase or decrease in hydrophobicity as the substrate is traversed in the flow direction (see paragraph 25). The water repellent layer may comprise particulate carbon and PTFE and may change compositionally as the substrate is traversed in the flow direction (see paragraph 25). Regarding claim 12, the upstream structure of the diffusion layer would inherently function to prevent drying of the cell, and the downstream structure of the diffusion layer would inherently function to prevent flooding of the cell. Regarding claim 12, the loading of the electrocatalyst metal may be varied as the catalyst layer is traversed in-plane (see paragraph 44; claim 18 of the reference). Additionally, regarding claim 12, the reference teaches that the substrate may comprise a coating having an ionically conductive polymer therein, the composition of the coating changing in-plane (see par. 25).

While the reference teaches that the loading of the electrocatalyst metal may be varied as the catalyst layer is traversed in-plane, the reference does not expressly teach that the pore size or pore amount in the catalyst layer are varied in-plane, as recited in claims 13, 14, 17, and 18, or that the catalyst layer has a structure whereby the upstream portion prevents drying of the fuel cell and the downstream portion prevents flooding of the fuel cell, as recited in claim 12.

However, the disclosure of Wilkinson et al. would give the artisan sufficient guidance to ascertain that the pore size and pore amount in the catalyst layer of the reference are varied as the layer is traversed in-plane, as recited in claims 13, 14, 17, and 18. As is known to a skilled artisan, the “catalyst loading” disclosed by the reference refers to the amount (i.e., mass) of catalyst per unit area of surface. Since it may reasonably be assumed that the thickness of the catalyst layer is constant, a catalyst loading which decreases in the flow direction would mean that the catalyst layer would contain less and less material, and therefore would become progressively less dense. Hence, the pore volume and/or pore size between the catalyst particles would progressively increase. Thus, the subject matter recited in claims 13, 14, 17, and 18 would be rendered obvious to a skilled artisan. Regarding claim 12, the upstream structure of the catalyst layer would function to prevent drying of the cell, and the downstream structure of the catalyst layer would function to prevent flooding of the cell.

Wilkinson further does not expressly teach that the catalyst layer *per se* comprises a polymer electrolyte resin as one of the components of the layer, the resin being present in a larger proportion at an upstream portion of the catalyst layer, as recited in claim 12.

Cavalca et al. is directed to a membrane electrode assembly. In paragraphs 124 and 141, the reference teaches that the electrode comprises ionically conductive polymer having the same composition as the polymer electrolyte in a position directly adjacent the electrolyte membrane (i.e., in the catalyst layer).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated by Cavalca to include an ionically conductive polymer in the catalyst layer of Wilkinson. First, as noted above,

Wilkinson contemplates ionomer components in variable-component coatings on the electrode substrates. Further, in paragraph 124, Cavalca teaches that such inclusion of ionomer in his electrode “improve[s] the contact of the electrode to the membrane and increase[s] catalyst utilization.” As such, the artisan would be motivated to include an ionically conductive polymer in the catalyst layer of Wilkinson, directly adjacent the membrane. Further, there would also be sufficient motivation to vary the amount of ionomer in the catalyst layer, as suggested by Wilkinson in paragraph 25. Accordingly, the claimed subject matter would be rendered obvious to the skilled artisan.

Allowable Subject Matter

9. Claims 1-3 and 6-11 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, first and second paragraphs, set forth in this Office action.

10. Claims 15, 19, 23, and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject matter:

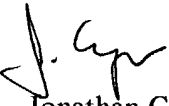
The instant claims contain recitations that the thickness of the catalyst layer changes along a reactant flow direction. Wilkinson et al., the closest prior art, discloses a varying catalyst loading but does not fairly suggest a varying catalyst layer thickness. As such, the instant claims contain allowable subject matter.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr, can be reached at (571) 272-1414. The phone number for the organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Jonathan Crepeau
Patent Examiner
Art Unit 1746
June 28, 2004